A COMPARISON OF TRADING MODELS USED FOR CALCULATING AGGREGATE DAMAGES IN SECURITIES LITIGATION

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I

INTRODUCTION

For approximately two decades, the General Trading Model ("GTM") has been used in securities litigation to estimate the number of shares damaged by alleged fraudulent misrepresentations by defendants. The GTM estimates the fraction of in-and-out trading volume and the fraction of retained volume. "In-and-out volume" refers to shares bought and sold within the class period; "retained volume" refers to shares purchased and held through the final disclosure that reveals the fraud. This is typically the last day of the class period. Estimates of the number of damaged shares from the GTM have been used in conjunction with a theory of true value (or conversely, artificial inflation) for the security to estimate aggregate monetary damages.[1]

Over the years, variations of the GTM predicated on different assumptions and/or parameters have been developed. The variations include single-trader models, such as the proportional and accelerated trading models, and multi-trader models.[2] This article compares the results of these models and critically evaluates the conclusions reached in previously published research.

This article demonstrates that results from the proportional single-trader model, GTM (1x), are consistent with the results of multi-trader GTMs when appropriate assumptions and parameters are used. No evidence was found to reject the GTM (1x) as a scientific method to estimate the number of damaged shares in securities litigation.

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1. For example, Forensic Economics used the GTM in conjunction with a theory of true value to provide damage estimates of $8.5 billion in the Cendant securities litigation, the largest class action securities litigation settlement in history. *See generally In re* Cendant Corp. Sec. Litig., 109 F. Supp. 2d 285 (D.N.J. 2000).

2. Virtually every securities litigation case in which aggregate damages are estimated relies on a version of the GTM for the number of shares damaged and the damage theory for the amount of artificial inflation. *See id.*

II
BACKGROUND

In securities litigation, damages arise when defendants make false or misleading statements that artificially inflate the stock price.[3] If an investor purchases the stock at this artificially inflated price, and the price later declines when the fraud is revealed, the investor will suffer damages from paying too much for the stock. In general, damages per share are calculated as the artificial inflation when the shares were purchased minus the artificial inflation when the shares were sold. For example, shares purchased when the stock price was artificially inflated and held through a disclosure that reveals the fraud typically are considered to be damaged. Shares purchased and then sold before any revelation of the fraud, however, are typically not considered to be damaged because these shares were passed on before any deflation in value.

Experts on damages in securities class actions generally do not have access to the trading records of individual class members. Consequently, the number of damaged shares is commonly estimated from a security's reported daily trading volume. Although the reported trading volume is quite reliable, the number of damaged shares is generally less than reported volume for several reasons.

First, reported volume may overstate the trading volume by the plaintiff class because it includes trades by specialists on the New York Stock Exchange ("NYSE") or market makers on the National Association of Securities Dealers Automated Quotation system ("NASDAQ") who buy from one investor and sell to another. One must adjust the reported volume to remove these double-counted trades. Recently published research suggests that a suitable correction is obtained by reducing NYSE reported volume by approximately ten percent and reducing NASDAQ volume by approximately fifty-eight percent.[4]

A second adjustment to volume is necessary to eliminate shares that were purchased during the class period and sold before the revelation of the alleged fraud. In many cases, these in-and-out shares have no associated damages because they were purchased and sold at prices with the same artificial inflation.[5] Historically, it has been common practice among economic experts for both plaintiffs and defendants to adjust volume for non-damaged, in-and-out volume using a statistical trading model.[6] The trading model is a mathematical model

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3. Artificial inflation is the difference between the actual stock price and what the true value of the stock would have been but for the false or misleading information.

4. *See* Harindra de Silva et al., *Securities Act Violations: Estimation of Damages*, *in* LITIGATION SERVICES HANDBOOK: ROLE OF THE ACCOUNTANT AS EXPERT WITNESS 44-31 (Roman L. Weil et al. eds., 2d ed., 1995); John F. Gould & Allan W. Kleidon, *Market Maker Activity on NASDAQ: Implications for Trading Volume*, STAN. J.L. BUS. & FIN., Fall 1994, at 11, 14, 21.

5. However, in-and-out shares may be damaged if more than one corrective disclosure is involved.

6. *See generally* de Silva et al., *supra* note 4, at 44-21 to 44-32; Dean Furbush & Jeffrey W. Smith, *Estimating the Number of Damaged Shares in Securities Fraud Litigation: An Introduction to Stock Trading Models*, 49 BUS. LAW. 527, 531 (1994); Jon Koslow, *Estimating Aggregate Damages in Class-Action Litigation Under Rule 10b-5 for Purposes of Settlement*, 59 FORDHAM L. REV. 811 (1991); Craig

that estimates, on each day of the class period, the fraction of volume that is in-and-out volume and the fraction that is retained volume.[7]

Trading models generally require a calculation of the daily ratio of adjusted volume to float, where float is defined as the number of shares that could have been traded on a given day, and adjusted volume is defined as reported volume adjusted to eliminate intra-day market maker or specialist trades, and to eliminate insider trades.[8] This "adjusted volume-to-float" ratio is an important factor in virtually all trading models.[9] In particular, as the number of shares in the float declines, the number of retained shares estimated from a trading model also declines, all else being the same.[10]

It is commonly assumed that each share purchased during the class period has the same chance of being sold on a subsequent day of the class period as any other share in the float. This special case of the GTM is commonly known as the proportional trading (or proportional decay) model because of the proportionality assumption about trading propensities.[11] The trading propensity assumption is sometimes referred to as the acceleration factor.[12] The proportionality assumption treats the acceleration factor as equal to one.

If one adopts the proportional trading assumption, then shares purchased on day one of the class period have, on average, a probability of being sold on day two equal to the adjusted volume-to-float ratio on day two. If one assumes that shares purchased during the class period were, on average, more likely to have been sold later in the class period than other shares in the float, then a multiple that is greater than one would be applied to the adjusted volume-to-float ratio. Conversely, if one assumes that shares purchased in the class period were less likely to have been sold later in the class period than other shares in the float, then a multiple that is less than one would be applied to the adjusted volume-to-float ratio. When it is assumed that shares traded during the class period are more likely to be sold later in the class period than other shares in the float, one

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McCann et al., *Demystifying Stock Trading Models in Securities Class Action Lawsuits* (KPMG, Econ. Consulting Serv., N.Y., N.Y.), Aug. 1997, at 1.

7. When the full extent of the fraud is revealed through several partial disclosures, it is usually important to determine the number of shares that were purchased during the class period and held through each partial disclosure. For example, if two distinct stock price drops can be attributed to the fraud, then in-and-out shares purchased before the first price drop, but sold before the second price drop, would normally be damaged in-and-out shares.

8. Float is generally determined by subtracting any shares known not to have traded over a portion of the class period from total shares outstanding. For example, insider trading records and quarterly institutional holdings are used to estimate the number of shares owned by insiders and institutions that were not traded. The float also is adjusted for share offerings or buybacks and for short interest positions. *See* de Silva et al., *supra* note 4, at 44-22 to 44-24.

9. Mathematically, the computation of retained shares is a function of the volume-to-float ratio. Specifically, using a GTM (1x) model, the number of retained shares from purchases on day one of a three-day class period equals the number of shares purchased on day one multiplied by the product of the quantity (one minus the volume-to-float ratio) on day two and the quantity (one minus the volume-to-float ratio) on day three. *See id.* at 44-25 to 44-32.

10. This mathematical property follows from the algebra of the GTMs.

11. *See* Furbush & Smith, *supra* note 6, at 534.

12. *See* McCann et al., *supra* note 6, at 4.

is applying what is called an accelerated trading model.[13] Although the terms "proportional trading model" and "accelerated trading model" connote separate models, they are both GTMs with different assumptions about trading propensities during the class period. Therefore, this article shall refer to a model as the GTM (1x) when one assumes an acceleration factor of one (proportional assumption), and GTM (1.1x) or GTM (.9x) for acceleration factors of 1.1 and 0.9, respectively.

III

A COMPARISON OF SINGLE-TRADER AND MULTI-TRADER MODELS

Recently the proportionality assumption in the GTM (1x) has been criticized.[14] Theoretical criticisms of the single-trader GTM (1x) center around a mathematical proposition asserted by William Beaver, James Malernee, and Michael Keeley that the number of damaged shares estimated from a two-trader model is substantially less than the number estimated from a proportional trading model.[15] The two-trader model divides a company's shares into two groups: those held by active traders and those held by passive traders. Daily trading volume for each group is determined by the relative propensities to trade that are assumed for the active-trader and for the passive-trader groups. Given the assumptions about the fraction of shares held by each trader group and the fraction of trading volume attributed to each trader group, estimates of retained shares and in-and-out shares are computed using a GTM (1x) for each group.

The two-trader model has two key assumptions that are not present in the single-trader model: (1) The percentage of total shares outstanding held by active and passive traders are different; and (2) The active and passive traders have different trading propensities (for example, the active trader may be as-

13. *See* Furbush & Smith, *supra* note 6, at 533.

14. The criticism generally has emanated from individuals associated with Lexecon or Cornerstone Research, two firms that provide economic consulting and expert testimony in securities class action cases primarily for defendants. *See generally* Janet Cooper Alexander, *The Value of Bad News in Securities Class Actions,* 41 UCLA L. REV. 1421, 1461-62 (1994); William H. Beaver & James K. Malernee, *Estimating Damages in Securities Fraud Cases Slides*, *in* HOW TO PREPARE FOR AND SUCCESSFULLY TRY A SECURITIES CLASS ACTION IN THE POST-REFORM ERA 631 (PLI Corp. Law & Practice Course Handbook Series No. 627, 1990); William H. Beaver et al., *Potential Damages Facing Auditors in Securities Fraud Cases*, *in* ACCOUNTANTS' LIABILITY: THE NEED FOR FAIRNESS 113 (John T. Behrendt et al., eds., 1994); Kenneth R. Cone & James E. Laurence, *How Accurate are Estimates of Aggregate Damages in Securities Fraud Cases?*, 49 BUS. LAW. 505 (1994); Edward J. Yodowitz & Steven J. Kolleeny, *Changing the Standard of Joint and Several Liability to a Proportional Liability Rule*, *in* SECURITIES CLASS ACTIONS: ABUSES AND REMEDIES 31 (National Legal Ctr. for the Public Interest ed., 1994).

15. For example, Alexander offers no independent analysis but merely asserts that "the use of the proportional trading assumption in calculating aggregate class damages accordingly may inflate the total class damages by 100%." Alexander, *supra* note 14, at 18, *citing* Beaver et al., *supra* note 14. Skudder, having cited Alexander and also the empirical findings of Cone and Laurence as his bases, asserts that "because the proportional decay model overstates the retention shares traded during the class period, damages will be overstated." Michael Y. Scudder, *The Implications of Market-Based Damages Caps in Securities Class Actions*, 92 NW. U.L. REV. 435, 451 (1997).

sumed to be two times, five times, ten times, or even twenty times more likely to trade than the passive trader).[16]

Beaver et al. simulate a case in which they assume that the class period is 100 days, the number of shares outstanding is 10 million, daily volume is 100,000 shares, twenty percent of shares are held by active traders, and active traders are twenty times more likely to trade than passive traders.[17] They report that their two-trader model yields 3,477,350 retained shares.[18] They compute the number of retained shares using a GTM (1x) to be 6,339,680.[19] Because the two-trader model yields only 54.9% (3,447,350 / 6,339,680) of the retained shares obtained from their GTM (1x), they conclude that the GTM (1x) overstates retained shares and, therefore, overstates aggregate damages.[20]

To illustrate this mathematical proposition, Beaver et al. compared the results of each model to actual depository records that they obtained while working on an unnamed securities case.[21] The authors state that the class period was 128 days and that the average trading volume was 2.2% of the shares outstanding.[22] Their published work claims that their two-trader model matched the actual depository data, which showed that 49.5% of total shares outstanding were retained and submitted for damage claims.[23] The results of their GTM (1x), however, yielded a number of retained shares that was 94.1% of shares outstanding.[24]

A. Beaver, Malernee, and Keeley's Results from Their GTM (1x) Are Flawed Because They Do Not Compute Float and They Do Not Adjust Reported Volume

In their comparison to the depository records, Beaver et al. mischaracterized how the single-trader GTM is used in current practice.[25] First, they used total shares outstanding instead of float in their volume-to-float ratio to compute retained shares.[26] As discussed above, it is standard practice—and critical to the analysis—that the float used to compute retained shares exclude all shares known not to have traded over the class period.[27] Beaver et al. make no attempt to do so in their GTM (1x). The amount of shares that would typically be ex-

16. The additional assumptions about relative trading propensities and the distribution of trading propensities are viewed by some researchers as a disadvantage. *See* Edward A. Dyl, *Estimating Economic Damages in Class Action Securities Fraud Litigation,* 12 J. FORENSIC ECON. 10, 11 (1999).

17. Beaver et al., *supra* note 14, at 125.

18. *See id.* at 126.

19. *See id.*

20. *See id.* at 126-27.

21. *See id.* at 128-30.

22. *See id.* at 128.

23. *See id.*

24. *See id.*

25. Also, Beaver et al. do not explain whether the depository records they obtained include all trading volume over the class period. *See id.* at 128-30.

26. *See id.* at 128.

27. *See* de Silva et al., *supra* note 4, at 44-21 to 44-37.

cluded from the float is substantial. For example, it is common for float to be less than 50% of shares outstanding for a class period of only 128 days.[28]

This same confusion over the proper use of the GTM (1x) is evident in the work of Daniel Fischel and David Ross.[29] They state that an indirect test of the GTM (1x) demonstrates that "the proportional trading decay model would predict that 142.6 million of Intel's 148.7 million shares outstanding were bought during 1990, although the institutional holding data shows that institutions held and did not trade 77.4 million."[30] Fischel and Ross predetermine the results of their indirect test by omitting an extremely important parameter of the GTM: the number of institutional shares that did not trade.[31] If they had properly used the institutional data to estimate Intel's float, the number of buy and hold shares predicted could not possibly have exceeded 71.3 million, the number of shares in Intel's float (71.3 million shares in the float is equal to 148.7 million total shares outstanding less 77.4 million shares held and not traded by institutions).[32] Therefore, Fischel and Ross put forth a straw man calculation of retained shares by failing to adjust the float properly in their model for the institutional trading data. Then they criticize the single-trader GTM because the calculated estimation of retained shares does not comport with the institutional trading data.[33]

Second, Beaver et al. apparently failed to adjust volume for specialist or market-maker trading.[34] Adjusting the reported volume lowers the number of retained shares. It is common practice to adjust reported volume for specialist (NYSE firms) or market maker (NASDAQ firms) trading.[35] As previously noted, reported volume should be reduced by approximately twenty percent for NYSE stocks and by approximately fifty-eight percent for NASDAQ stocks. While this adjustment was not discussed in Beaver et al.'s published work, Cornerstone Research summarized the work in its Web page and stated that this adjustment to volume is "an additional problem not discussed here [in their paper]."[36] Because the authors did not adjust reported volume when they estimated damaged shares, their proportional trading model overstated retained shares by omitting this important parameter.

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28. For example, see Plaintiffs Expert Reports, *In re* Gaming Lottery Sec. Litig., No. 96 Civ. 5567, 2001 U.S. Dist. LEXIS 1204, at *1 (S.D.N.Y. Feb. 8, 2001).

29. *See generally* Daniel R. Fischel & David J. Ross, *The Use of Trading Models to Estimate Aggregate Damages in Securities Fraud Litigation: A Proposal for Change*, *in* SECURITIES CLASS ACTIONS: ABUSES AND REMEDIES 131 (National Legal Ctr. for the Public Interest ed., 1994).

30. *Id.* at 139.

31. *See id.*

32. This analysis of float does not reflect any effect from insider holdings or short interest positions. *See id.*

33. *See id.*

34. *See* Beaver et al., *supra* note 14, at 128-30.

35. *See* de Silva et al., *supra* note 4, at 44-21 to 44-37; s*ee also* Gould & Kleidon, *supra* note 4, at 13.

36. William H. Beaver et al., Stock Trading Behavior and Damage Estimation in Securities Cases 8 (1993) (unpublished manuscript, available at the Cornerstone Research website) (last modified Jan. 19, 2000) <http://www.cornerstone.com/fram_sea.html>.

Chart A of the Appendix shows the results from a simulation using a GTM (1x) for a class period of 128 days and for average daily volume of 2.2% of total shares outstanding. With no adjustment to the float or reported volume, the GTM (1x) trading model yields damaged shares that are 94.2% of shares outstanding, which is similar to the 94.1% reported by Beaver et al. using actual data. Using the same GTM (1x), but now estimating float to be fifty percent of shares outstanding and adjusting reported volume by the NYSE factor of twenty percent, the number of damaged shares is only 49.2% of shares outstanding (see Chart A). Therefore, with the correct adjustment to reported volume and plausible assumptions about float, the number of retained shares estimated from a GTM (1x) are approximately equal to the actual number of retained shares as reported by Beaver et al. based on depository records.[37]

B. The Twenty Percent Active and Eighty Percent Passive Trader Assumption Used by Beaver, Malernee, and Keeley Appears to Have Been Chosen to Exaggerate the Differences Between the Proportional Trading Model and the Two-Trader Model

The assumptions that Beaver et al. used to estimate their two-trader model exaggerate the difference between the number of retained shares using the two-trader model and the proportional trading model. Beaver et al. illustrate an example in which active traders hold a constant twenty percent of the stock over a 100-day class period and active traders are twenty times more likely to trade than passive traders.[38] They show that the two-trader model yields fifty-five percent of the total retained shares that result from a GTM (1x).[39]

As Chart B demonstrates, the twenty percent active-trader assumption Beaver et al. chose for their hypothetical example results in the greatest possible difference between the models holding the relative propensity of active and passive traders to trade alike. That is, if one assumes that the active traders held more than twenty percent, or less than twenty percent of the shares outstanding, the number of retained shares from the two-trader model increases, and the difference between retained shares estimated from the two-trader model and retained shares estimated from the GTM (1x) declines.

Moreover, most of the sample data of trading activity do not support the twenty percent active and eighty percent passive distribution asserted by Beaver et al.[40] To the contrary, the trading data conform more to a normal, bell-shaped distribution.[41] Kenneth Froot, Andre Perold, and Jeremy Stein present a decomposition of share turnover for nine groups of traders: Active Pension Funds, Passive Pension Funds, Foundations/Endowments, Self-directed Households,

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37. Since Beaver et al. reveal neither the company nor the class period for which they are calculating damaged shares, it is not possible to make an accurate assessment of the float.

38. *See* Beaver et al., *supra* note 14, at 126.

39. *See id.*

40. *See* KENNETH A. FROOT ET AL., SHAREHOLDER TRADING PRACTICES AND CORPORATE INVESTMENT HORIZONS (National Bureau of Econ. Research Working Paper No. 3638, 1991).

41. *See id.* at 57 tbl. 1.

Bank Trust Departments for Households, Insurance Companies, Mutual Funds, Foreign Investors, and Others.[42] Froot et al. report the percentage held by each group and the average share turnover for each group.[43]

Using turnover statistics from Froot et al., relative trading propensities were computed by dividing each group's reported turnover statistic by the turnover statistic for the group with the lowest turnover (Passive Pension Funds). The trading propensities ranged from 1.0 to 7.4. The data show that five percent of equity holdings are Passive Pension Funds that have the lowest turnover and thus a trading propensity of one. Approximately fifty-six percent of equity holdings have a trading propensity between 1.5 and 1.9, approximately thirty-two percent of equity holdings have trading propensities between 2.9 and 3.8, and seven percent of equity holdings have trading propensities between 6.5 and 7.4. Chart A shows the results of this calculation.

These statistics were used to estimate a four-trader model before comparing the results from this four-trader model with the GTM (1x) using the same assumptions about daily volume and float used by Beaver et al. The number of retained shares estimated from the four-trader model using the statistics from Froot et al. are approximately ninety-two percent of the results from the GTM (1x).

Thus, a more sophisticated multi-trader model that makes use of actual data about trading propensities results in retained shares estimates that are quite similar to that of the GTM (1x). This result should not be surprising. The GTM (1x), when used correctly, is essentially a two-trader model because shares are eliminated from the float and therefore eliminated from damages. Shares that are eliminated from the float have a trading propensity that is equal to zero, because they are known not to have traded during the class period. Thus, the model has one (often large) group of traders with a known trading propensity of zero during the class period. Shares that remain in the float, by design, have much more homogeneous trading propensities because the shares with the lowest trading propensities have been removed from total shares outstanding.

The sensitivity of the four-trader model results was tested by maintaining the general bell-shaped distribution for the number of traders in each trader group while increasing the range of relative trading propensities. That is, the study assumed that the lowest and highest trading-propensity groups are each approximately five to seven percent of shares outstanding but increased the range of trading propensities. Even assuming that the highest trading propensity is forty times greater than the lowest trading propensity, the results were still eighty-nine percent of the GTM (1x) (see Chart B). Thus, if the multi-trader model is applied with a distribution of traders that conforms to the observed empirical data, it does not result in the exaggerated differences of nearly fifty percent when compared with the proportional trading model as asserted by

42. *See id.*
43. *See id.*

the critics. The unrealistic trading propensities assumed by Beaver et al. in their two-trader model significantly understate the number of retained shares when compared with a multi-trader model using a distribution of trading propensities that is more consistent with observed trading propensities.

C. The Magnitude of the Difference Between the Two-trader Model and the GTM (1x) Is Sensitive to the Length of the Class Period

Beaver et al. use a hypothetical class period of 100 days when they compare the results from a proportional trading model with a two-trader model.[44] Chart C shows the ratio of the number of retained shares from the two-trader model (with twenty percent active shares and eighty percent passive shares) to the number of retained shares from the GTM (1x) for various assumptions about relative trading propensities and the length of the class period. Chart C illustrates that as the class period becomes shorter than 100 days or greater than 150 days, this ratio increases using any assumption about trading propensities.

IV

EMPIRICAL EVIDENCE

Kenneth Cone and James Laurence's work is the most frequently cited empirical evidence on the accuracy of trading models. They cite two cases in which the damage estimates from the plaintiffs' experts, who used a proportional trading model, exceeded the aggregate claims filed.[45] Cone and Laurence criticize the proportional trading assumption (referring to it as the "uniform" assumption) on several grounds and state that "the ultimate test of any model lies in how well it predicts the bottom line."[46] The "bottom line" for them is the difference between the predicted aggregate damages and the actual aggregate damages awarded through the claims process.[47] The two cases they cite involve *Midwestern* and *Storage Technology*, NASDAQ and NYSE stocks, respectively.

A. Testing Trading Models with Anecdotal Claims Data Can Be Grossly Misleading

1. Storage Technology. For the *Storage Technology* case, Cone and Laurence report that the proportional trading model overestimates the number of buy-and-hold shares that entered the class compared with the buy-and-hold claims submitted.[48] They report that for Storage Technology, only 9.3 million

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44. *See* Beaver et al., *supra* note 14, at 125.

45. The two cases cited are *Biben v. Card*, 789 F. Supp. 1001 (W.D. Mo. 1992) and *Levit v. Aweida*, 630 F. Supp. 1072 (D. Colo. 1986). *See* Cone & Laurence, *supra* note 14, at 507.

46. *Id.* at 522, 530.

47. *See id.* at 530.

48. *See id.* at 537.

buy-and-hold shares were submitted for a claim, which was about one-third of the estimated buy-and-hold shares from their proportional trading model.[49]

A comprehensive analysis of share ownership in the *Storage Technology* case, however, demonstrates that use of claims data as a benchmark for the number of Storage Technology shares that were bought and held is misleading and inappropriate. In reaching this conclusion, institutional holdings of Storage Technology over the class period as reported by Thomson Financial Securities Data ("Thomson") were reviewed. Thomson records the shares of a stock held by each institution at the end of each quarter from the 13-F Securities and Exchange Commission ("SEC") filings that institutions are required to file. According to Thomson, there were 135 institutions that held 15.6 million shares (approximately fifty percent of shares outstanding) of Storage Technology at the end of the quarter before the beginning of Storage Technology's class period. The data show that approximately 15.4 million of the 15.6 million shares owned by institutions were sold during the class period.[50] Thus, the 9.3 million shares submitted for claims reflect only sixty percent of the buy-and-hold shares originally held by institutions and none of the buy-and-hold shares originally held by individual investors (who owned approximately fifty percent of the total shares outstanding). The 9.3 million buy-and-hold shares submitted for claims are a misleading and inappropriate benchmark for assessing the efficacy of any trading model.

Just how poor is the use of claims data to assess the trading model for Storage Technology? Although we do not have data on individual shareholders as we do for institutions, certain facts about this case may provide some insight. The class period is over two years long, Storage Technology lost seventy-five percent of its market value of equity over the same time period in which the market increased by sixty-five percent, and institutions turned over nearly their entire holdings of Storage Technology stock during the class period.[51] Reported volume over the class period was over 125 million shares, which, with 33 million shares outstanding, reflects a share turnover of about 380%.[52] It would be remarkable to find that that many individuals who held Storage Technology stock before the class period did not sell during the class period. Thus, the number of buy-and-hold shares from claims submissions vastly underestimates the actual number of shares of Storage Technology that were bought and held.

Contrary to the conclusion of Cone and Laurence, the proportional trading model may well provide a very good estimate of buy-and-hold shares in this case. It is clear, however, that Storage Technology's claims data are of little use

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49. *See id.*

50. For each institution, the lowest balance of shares it held during the class period was determined before subtracting that balance from the number of shares it held before the beginning of the class period.

51. *See* S&P 500 Index, Standard and Poors (visited Mar. 8, 2001) <http://www.spglobal.comindex main500_data.html>; Center for Research in Securities Prices (visited Mar. 7, 2001) <http://www.gsb.uchicago.edu/research/crsp/index/html>.

52. *See* Center for Research in Securities Prices, *supra* note 51.

in assessing whether the number of buy-and-hold shares predicted by the GTM (1x) is accurate (see Chart C). This is because the *Storage Technology* case is an old case dating back to 1982, and the case was decided over six years after the end of the class period at issue.[53] According to deposition testimony, the claims administration for this case was poorly conducted by today's standards.[54] Evidently, the proof of claims form was difficult to understand as the form said nothing about damages and was required to be returned by registered mail.[55]

2. Midwestern. For *Midwestern*, Cone and Laurence report in Table 6 of their report that the buy-and-hold shares submitted for claims equaled eighty-seven of the shares predicted from a GTM (1x) when a proper adjustment to NASDAQ reported volume was used.[56] Considering the potential for claims data to vastly underestimate actual buy-and-hold shares, as evidenced by the *Storage Technology* case, this difference of 230,000 shares (13% of the 1.78 million share prediction) would appear to support the GTM (1x) result, rather than to provide evidence against its use (See Table D). It is not contended here that the *Midwestern* claims data supports the use of the proportional trading model, but rather that the claims data fail to support the critics' contentions that the proportional trading model dramatically overstates retained shares.

B. Testing Trading Models with Anecdotal Claims Data Can Be Inappropriate

Cone and Laurence simultaneously test the efficacy of the proportional assumption and the reasonableness of plaintiffs' damages theory. In most of their analysis, Cone and Laurence focus on aggregate dollar damages rather than on the number of damaged shares.[57] Because they compare the aggregate dollar damages estimated with a proportional trading model with the aggregate damage claims, their analyses involve a simultaneous testing of the results of the proportional trading model (damaged shares) and the plaintiff's damage theory (artificial inflation per share). Unless the per share damages used in claims administration are exactly the same as the per share damages used by the damages expert, estimated aggregate dollar damages will always deviate from the aggregate dollar damages that result from claims. This deviation will occur even if the number of damaged shares estimated by the expert equals the number of damaged shares derived from claims.

Therefore, the comparison of predicted and actual aggregate dollar damages is of limited usefulness when testing the accuracy of a particular trading model because the comparison confounds the effects of the damage theory (value line) and the effects of the trading model itself. Although there is certainly a strong

53. *See* Deposition Testimony of John Torkelsen, Ziemack v. Centel, No. 92-C-3551, 1997 U.S. Dist LEXIS 2198 (N.D. Ill. Feb. 26, 1997).

54. *See id.*

55. *See id.*

56. Cone and Laurence reduce the reported volume by 67%, which they indicate is within the plausible range for the NASDAQ reporting bias. *See* Cone & Laurence, *supra* note 14, at 515.

57. *See generally* Cone & Laurence, *supra* note 14.

connection between aggregate damages and the number of damaged shares, conclusions about the accuracy of trading models should not be dependent upon a particular damage theory.

Moreover, there is an important economic distinction between the number of damaged shares and the number of shares submitted for claims in class action securities litigation. In any securities litigation, it is unlikely that all shareholders who were damaged would file claims. Each shareholder faces an economic decision about whether the time and effort required to retrieve trading records and complete the proof of claims forms is worth the expected damage award. But this individual decision about whether to file a claim does not alter the economic fact that a given share was damaged.

Understanding the relation between trading models and claims data can provide important insights about both the trading model and the claims process. But, given the fundamental economic distinction between damaged shares and claims filed, Cone and Laurence are making a legal conclusion when they assert that the test of a trading model is its ability to predict claims. This conclusion is erroneous, and the logic behind it is flawed in a way that may result in bad public policy, as explained below.

It is generally accepted that the number of claims filed in a given case is a function of the amount of the damage award. The greater the damage award, the more likely shareholders are to spend their time and resources retrieving trading records and completing the proof of claims forms. The damage award is, in turn, a function of the predicted aggregate damages that are based in part on the results of a trading model. Therefore, it follows logically that the number of expected claims filed is a function of the predicted damages. Thus, trying to estimate the number of claims filed in the damage calculation is circular. That is, the lower the damage estimate, the lower the number of expected claims will be, but the lower the number of expected claims, the lower the damage estimate will be, and so on. This circular logic is in itself a compelling reason to keep the damages estimates separate from any estimates of claims filed.

C. More Recent Evidence from Claims Data

The two cases cited by Cone and Laurence provide only anecdotal evidence regarding the ability of trading models to predict claims data. Conclusions from a sample of two observations will not have a high degree of statistical significance, particularly when the results of the analyses differ dramatically between the two cases.

In addition, the two cases examined by Cone and Laurence are now quite old. There are other more recent cases in which the claims data do not support the critics' contentions that the proportional trading model overestimates the number of damaged shares. For example, in the *In re Health Management, Inc. Securities Litigation* case, plaintiffs' expert estimated that 5.631 million shares

were damaged based on a GTM (1x).[58] The claims data showed that 5.014 million shares, or eighty-nine percent of the estimated number of damages shares, were submitted for claim.[59] Furthermore, had the plaintiffs' expert reduced reported NASDAQ volume by sixty-seven percent, as advocated by Cone and Laurence, instead of the fifty percent reduction actually used, the damaged shares from claims submissions as a percent of the GTM (1x) estimated shares would be greater than ninety percent. Therefore, it is more reasonable to conclude that the GTM(1x) is supported by the claims data in this case.

V

SUMMARY

Single-trader models (including the proportional and accelerated trading models) and multi-trader models are all GTMs with different assumptions and/or parameters. This article compared the results of these models and critically evaluated the conclusions reached in previously published research.

Beaver, Malernee, and Keeley's comparison between their two-trader model and the proportional trading model is flawed because they do not compute float and they do not adjust reported volume.[60] Furthermore, the twenty percent active to eighty percent passive trader assumption used by Beaver et al. appears to have been chosen to exaggerate the differences between the proportional trading model and the two-trader model. The unrealistic trading propensities assumed in their two-trader model significantly understates the number of retained shares when compared with a multi-trader GTM using a distribution of trading propensities that is more consistent with actual observed trading propensities.

The most often cited empirical evidence on the accuracy of the trading models is of highly questionable use. First, testing trading models with claims data can be misleading and inappropriate. Second, the individual decision of whether to file a claim does not alter the economic fact that a given share was damaged. Moreover, given the fundamental economic distinction between damaged shares and claims filed, the logic of using claims data as a benchmark is flawed in a way that may result in bad public policy.

The differences between actual damaged shares and shares reported as damaged from claims data are significant and appear to vary greatly from case to case. In the *Storage Technology* case, the 9.3 million shares submitted for claims reflect only sixty percent of the buy-and-hold shares originally held by institutions that owned approximately fifty percent of the total shares outstanding before the class period and subsequently sold during the class period.

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58. Order Approving Distribution of Settlement Fund, *In re* Health Management, Inc. Sec. Litig., 180 F.R.D. 40 (E.D.N.Y. 1999) (No. CV 96-889 (ADS)(ARL)).

59. *See* Rule 26 Report of J.B. Torkelsen, *In re* Health Management, Inc. Sec. Litig., 180 F.R.D. 40 (E.D.N.Y. 1999) (No. CV 96-889 (ADS)(ARL)); Deposition Testimony of J.B. Torkelsen, Oct. 20, 1999, at 1352-53, *Health Management* (No. CV 96-889).

60. *See* Beaver et al., *supra* note 14, at 128-30.

Thus, the 9.3 million buy-and-hold shares submitted for claims are a misleading and inappropriate benchmark, because that figure is well short of the actual damaged shares for institutional holders alone.

Conclusions from a sample of two observations will not have a high degree of statistical significance, particularly when the results of the analyses differ dramatically between the two cases as they do here. Furthermore, the two cases examined by Cone and Laurence are now dated, and there are other more recent cases in which the claims data do not support the critics' contention that the proportional trading model overestimates the number of damaged shares.

The results of the single-trader GTM (1x) are consistent with the results of multi-trader GTMs when appropriate assumptions and parameters are used. The estimated damaged shares from a properly specified four-trader model in which the trading propensities are generated from the observed empirical distribution yields about ninety-two percent of the estimated damaged shares from a GTM (1x). Thus, there is no evidence that would reject the GTM (1x) as a scientific method to estimate the number of damaged shares in securities litigation.

CHART A

SHARES ENTERING THE CLASS PERIOD AS A PERCENTAGE OF TOTAL SHARES OUTSTANDING FOR A CLASS PERIOD OF 128 DAYS

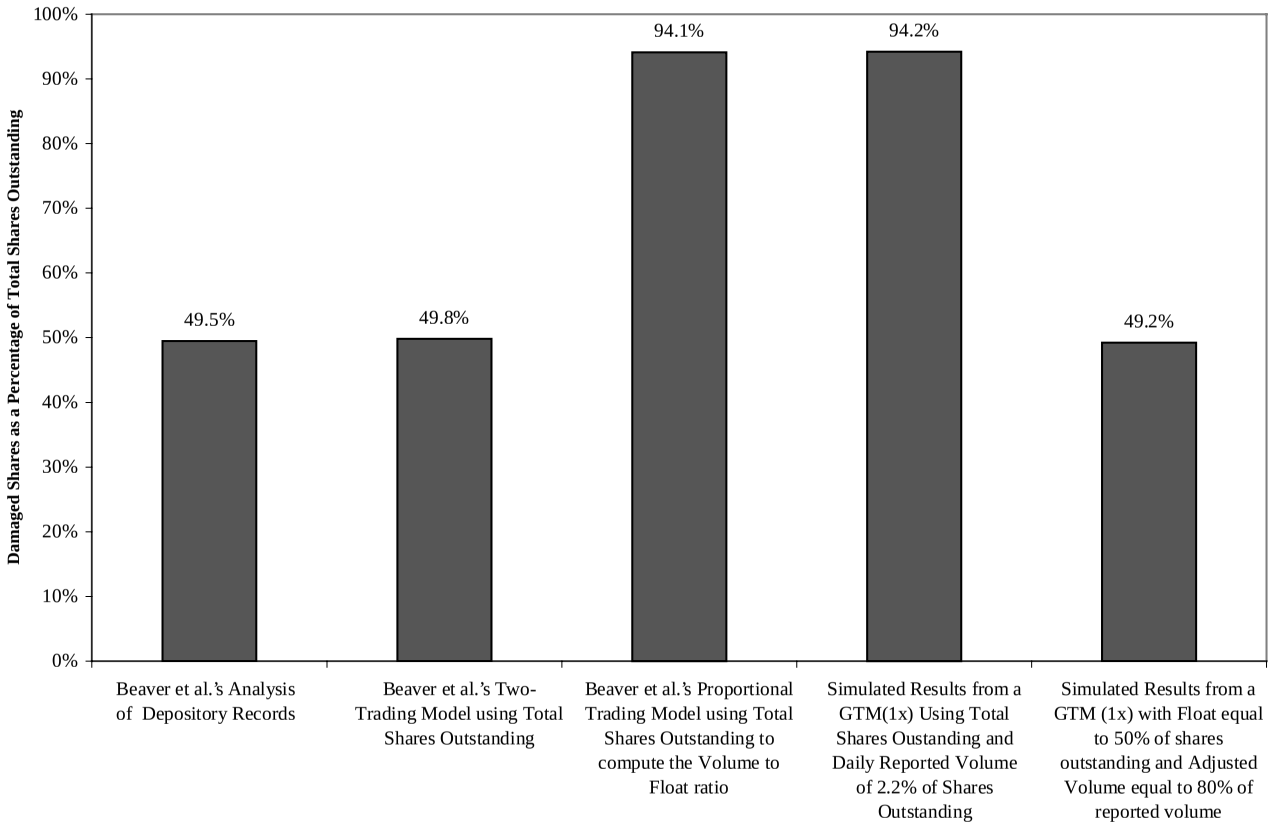

CHART B

RATIO OF RETAINED SHARES FROM A TWO-TRADER MODEL TO THE RETAINED SHARES FROM A SINGLE TRADER MODEL USING AN ACCELERATION FACTOR OF 1.0 (GTM 1 X) FOR A 100 DAY CLASS PERIOD

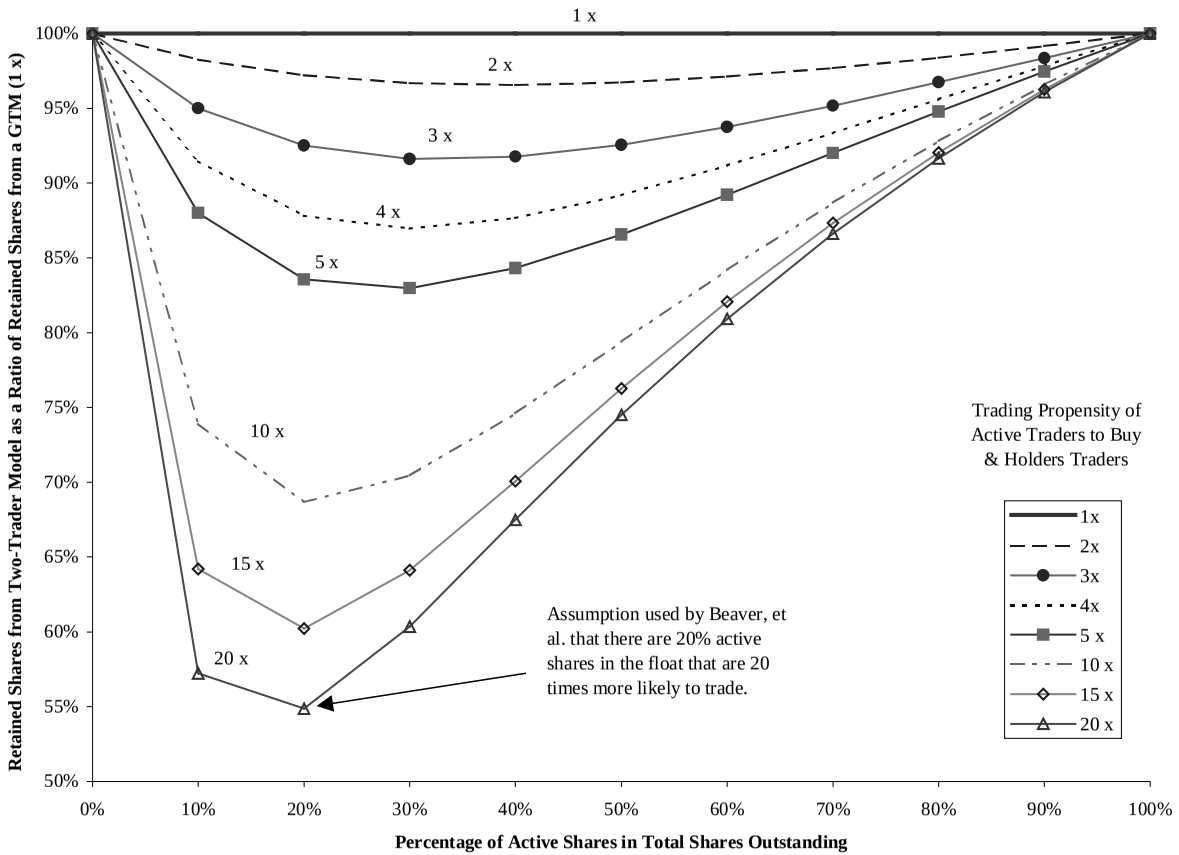

CHART C

RATIO OF RETAINED SHARES FROM A TWO-TRADER MODEL WITH 20% ACTIVE TRADERS TO THE RETAINED SHARES FROM A SINGLE TRADER MODEL WITH AN ACCELERATION FACTOR OF 1.0 (GTM 1 X)

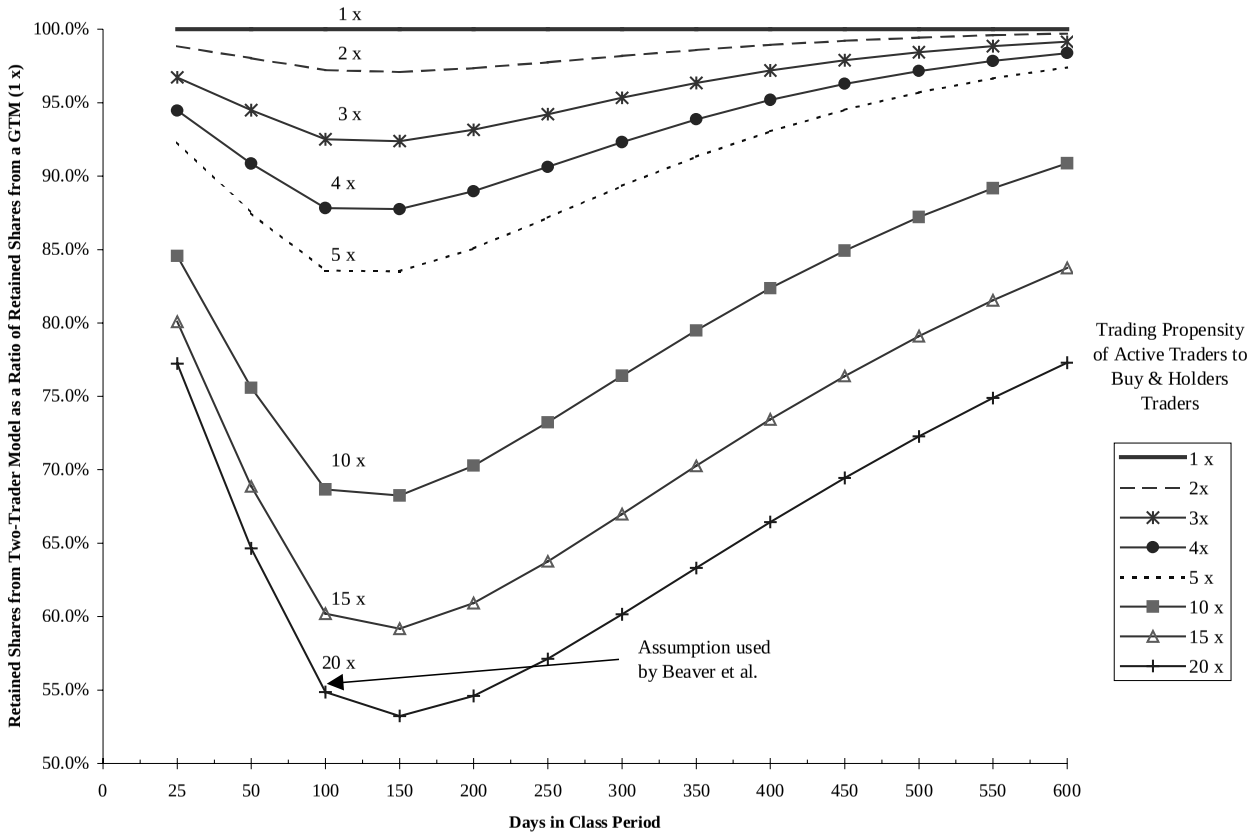

TABLE A

	Equity Holdings (12/89 $bil)	Percent Ownership	Percent Turnover	Trading Propensity	Grouping for 4-Trader Model	Percentage Ownership	Weighted-Average Trading Propensity
Passive Pension Fund	191	5.0	14	1.00	1	5	1.0
Self-directed Households	1723	45.0	21	1.50			
Foundations/Endowments	82	2.1	22	1.57	2	56	1.6
Bank Trust Department Households	332	8.7	26	1.86			
Insurance Companies	211	5.5	40	2.86			
Mutual Funds	240	6.3	52	3.71	3	32	3.6
Active Pension Fund	766	20.0	53	3.79			
Foreign	257	6.7	91	6.50			
Other/Unexplained	11	0.3	103	7.36	4	7	6.5
TOTAL	3813	100					

Source of data is Kenneth A. Froot et al., *Shareholder Trading Practices and Corporate Investment Horizons*, J. of Applied Corp. Fin.

TABLE B

Total Float = shares Outstanding	10,000,000
Daily Volume	100,000
Days in Class period	100

GTM (1x)	Total
Acceleration Factor	1.0
Retained Shares	6,339,677

Four Trader Model Based on Data from Froot et al.

	Total	**1**	**2**	**3**	**4**
Fraction of Float	100%	5%	56%	32%	7%
Propensity to Trade	NA	1.0	1.6	3.6	6.5
Daily Volume	100,000	1,966	35,114	45,025	17,895
Retained Shares	5,838,155	162,848	2,611,896	2,415,942	647,469
Percent of GTM (1x)	92.1%				

Four Trader Based on Sensitivity Analysis on Trading Propensities

	Total	1	2	3	4
Fraction of Float	100%	5%	56%	32%	7%
Propensity to Trade	NA	1.0	10.0	30.0	40.0
Daily Volume	100,000	278	31,052	53,088	15,582
Retained Shares	5,629,189	27,071	2,386,391	2,589,426	626,300
Percent of GTM (1x)	88.8%				

TABLE C

NUMBER OF SHARES OF STORAGE TECHNOLOGY SOLD INTO THE MARKET BEFORE THE END OF THE CLASS PERIOD THAT WERE HELD BY INSTITUTIONS PRIOR TO THE BEGINNING OF THE CLASS PERIOD

Institution	Shares Held at the Quarter-end Before the Begiining of the Class Period	Minimum Number of Shares Held Before the End of the Class Period	Number of Shares Sold before the End of the Class Period
CIGNA CORPORATION	1,697,937	0	1,697,937
PRUDENTIAL INS CO/AMER	1,462,600	0	1,462,600
DONALDSON LUFKIN	637,519	0	637,519
CHASE MANHATTAN CORP	636,173	0	636,173
INVESTORS RESEARCH CORP	600,900	0	600,900
HARRIS TRUST & SVGS BANK	519,000	0	519,000
SEARS INVESTMENT MGMT	382,700	0	382,700
AXE E W & CO INC	375,500	0	375,500
MACKAY SHIELDS FINANCIAL	336,132	0	336,132
GENERAL ELEC PENSION TR	317,000	0	317,000
WARBURG PINCUS COUNSELLR	308,340	0	308,340
WALL PATTERSON HAMILTON	298,081	0	298,081
EAGLE MGMT & TRUST CO	278,400	0	278,400
FIRST INTERSTATE/DENVER	262,916	1,239	261,677
SCUDDER STEVENS & CLARK	232,278	0	232,278
WELLINGTON MANAGEMENT	217,300	0	217,300
STATE FARM MUT AUTO INS	215,000	0	215,000
SMITH BARNEY INC	214,850	3,900	210,950
LOOMIS SAYLES	211,384	0	211,384
EXXON CORP	202,100	18,200	183,900
FOUNDERS ASSET MGMT INC	183,700	0	183,700
ROTHSCHILD L F ASSET MGT	177,000	0	177,000

Institution	Shares Held at the Quarter-end Before the Begiining of the Class Period	Minimum Number of Shares Held Before the End of the Class Period	Number of Shares Sold before the End of the Class Period
HERITAGE WISCONISN CORP	175,725	0	175,725
PACIFIC MUT LF INS CO	175,100	0	175,100
USAA INV MGMT CO	165,000	0	165,000
MANUFACTURERS LF INS CO	159,405	0	159,405
MARYLAND STATE RETIRMENT	159,300	0	159,300
WELLS FARGO & COMPANY	159,300	0	159,300
MUTUAL OF AMERICA LIFE	157,564	0	157,564
OPPENHEIMER & CO	153,218	0	153,218
KINGSLEY JENNISON MCNLTY	153,000	0	153,000
COLLEGE RETIRE EQUITIES	150,000	0	150,000
DEAN WITTER REY INTERCAP	143,950	0	143,950
SCHRODER CAPITAL MGMT	143,802	0	143,802
UNION CARBIDE CORP	141,900	0	141,900
FIRST INTERSTATE BANCORP	141,622	12,612	129,010
PROVIDENT INV COUNSEL	133,692	0	133,692
BANKERS TR N Y CORP	130,700	0	130,700
GLICKENHAUS	126,500	0	126,500
CITICORP	122,382	0	122,382
BANKAMERICA CORP	121,270	0	121,270
CRITERION GROUP INC	112,300	0	112,300
TRAVELERS CORP	104,000	0	104,000
CAMPBELL ADVISORS INC	101,600	0	101,600
VALUE LINE INC	100,300	0	100,300
STATE UNIV RET SYS/ILL	100,000	0	100,000
GTE INVESTMENT MGMT CORP	92,800	0	92,800
SEATTLE FIRST NATL BANK	86,650	0	86,650
STEIN ROE & FARNHAM	83,200	0	83,200
FIRST NATL BK/CINCINNATI	78,180	0	78,180
CENTRAL TRUST CO NA	76,150	0	76,150

Institution	Shares Held at the Quarter-end Before the Begiining of the Class Period	Minimum Number of Shares Held Before the End of the Class Period	Number of Shares Sold before the End of the Class Period
NORTHWESTERN MUT LF INS	76,000	0	76,000
PUTNAM COMPANIES	75,000	0	75,000
SENTRY INV MGMT INC	72,500	0	72,500
CIGNA INVESTMENT ADVISOR	70,000	0	70,000
AMERICAN NAT B+T/CHICAGO	69,700	83,500	-13,800
ST PAUL COMPANIES INC	66,400	0	66,400
BRUNDAGE STORY & ROSE	58,970	81,670	-22,700
FIRST CHICAGO CORP	58,592	0	58,592
INA CAPITAL MGMT CORP	57,800	0	57,800
PITTSBURGH NAT B/T DEPT	55,400	0	55,400
COMBINED INS / AMERICA	55,000	0	55,000
FIRST CITY BANCORP TEXAS	55,000	0	55,000
FIRST KENTUCKY NATIONAL	54,698	0	54,698
HUNTINGTON BANCS INC	53,800	0	53,800
BJURMAN GEORGE D & ASSOC	51,000	0	51,000
IDAHO FIRST NATIONAL BK	48,900	0	48,900
BANK OF OKALHOMA	40,500	0	40,500
ELFUN TRUSTS	40,000	0	40,000
FIRST PENNSYLVANIA CORP	38,060	0	38,060
CROCKER NATIONAL	34,500	0	34,500
WITTER WILLIAM D INC	32,900	0	32,900
MANUFACTURERS NATIONAL	32,860	32,860	0
BOSTON COMPANY INC	32,850	0	32,850
WERTHEIM & CO	31,974	12,500	19,474
AMERICAN TEL & TEL INDEX	31,200	31,200	0
LINCOLN NATIONAL CORP	30,200	0	30,200
MARSHALL & ILSLEY CORP	30,039	0	30,039
CONTINENTAL INV ADVISORS	30,000	0	30,000
MASSACHUSETTS FINL SVCS	30,000	0	30,000

Institution	Shares Held at the Quarter-end Before the Begiining of the Class Period	Minimum Number of Shares Held Before the End of the Class Period	Number of Shares Sold before the End of the Class Period
LEHMAN BROTHRS KUHN LOEB	28,990	0	28,990
BARCLAYS PLC	27,000	0	27,000
COMERICA INC	26,600	0	26,600
FIRST NATL BK&TR/LINCOLN	25,996	0	25,996
BULLOCK CALVIN	25,000	0	25,000
HONGKONG & SHANGHAI BANK	24,500	0	24,500
GIRARD BANK	23,900	0	23,900
CIC ASSET MANAGEMENT	23,762	0	23,762
BANK OF CALIFORNIA	23,060	0	23,060
NATIONAL INVT SVC/AMER	22,700	0	22,700
ESSEX INV MGMT CO INC	21,700	0	21,700
NEVILLE - RODIE & SHAW	20,000	0	20,000
WELCH & FORBES INC	19,258	0	19,258
BANK OF NEW JERSEY	18,000	0	18,000
RUSSELL FRANK CO INC	17,500	0	17,500
FORT HILL INVESTORS MGMT	16,680	0	16,680
NORTHERN TRUST CORP	16,480	0	16,480
BANK OF TOKYO LTD	15,000	0	15,000
EQUITABLE BANCORP	14,700	0	14,700
CHEMICAL BANKING CORP.	14,254	0	14,254
AMERITRUST CO	14,196	0	14,196
PROVIDENT NATIONAL	13,900	0	13,900
PHILADELPHIA NATIONAL BK	13,700	0	13,700
STATE STREET BOSTON CORP	13,000	0	13,000
VALLEY NATIONAL BK/ARIZ	12,200	0	12,200
COLUMBIA MANAGEMENT	12,000	0	12,000
CHASE LINCOLN FIRST BANK	11,858	0	11,858
COOLIDGE LAWRENCE	11,715	11,715	0
MANUFACTURERS HANOVER TR	11,600	0	11,600

Institution	Shares Held at the Quarter-end Before the Begiining of the Class Period	Minimum Number of Shares Held Before the End of the Class Period	Number of Shares Sold before the End of the Class Period
DOMINION TRUST COMPANY	11,000	0	11,000
METROPOLITAN LIFE INSUR	10,800	0	10,800
TRAINER WORTHAM & CO	10,400	0	10,400
KEMPER FINANCIAL SERVICE	10,000	0	10,000
UNIVERSITY OF TEXAS SYS	10,000	0	10,000
HUNTINGTON BK/N.E. OHIO	9,550	0	9,550
FIRST NATL BK/MINNEAPLIS	9,500	0	9,500
NATIONAL CITY BANK	9,307	0	9,307
BANC OHIO NATL BK	8,807	0	8,807
TCW ASSET MANAGEMENT	8,100	0	8,100
INTERFIRST CORPORATION	8,000	0	8,000
ROCKEFELLER & CO	8,000	0	8,000
HARVARD COLLEGE	7,055	0	7,055
MORGAN STANLEY GROUP INC	6,700	0	6,700
FIDUCIARY TR CO/NEW YORK	6,079	0	6,079
NEUBERGER & BERMAN	5,690	0	5,690
SCHRODER J HENRY BK&TR	5,296	0	5,296
COLONIAL BANK	4,876	0	4,876
BANK OF DELAWARE	3,700	0	3,700
MICHIGAN NATL BK/DETROIT	2,900	0	2,900
AETNA LIFE & CASUALTY CO	2,500	0	2,500
IRVING TRUST CO	2,494	0	2,494
BATTERYMARCH FINL MGMT	2,400	0	2,400
EATON VANCE MANAGEMENT	1,600	0	1,600
CITYTRUST	1,560	0	1,560
SHIELDS ASSET MGMT INC	1,000	0	1,000
Total Institutions	15,635,826	289,396	15,346,430

Source: Thomson Financial Securities Data

TABLE C-2

NUMBER OF SHARES OF STORAGE TECHNOLOGY SOLD INTO THE MARKET BEFORE THE END OF THE CLASS PERIOD THAT WERE HELD BY INSTITUTIONS PRIOR TO THE BEGINNING OF THE CLASS PERIOD

Institution	Jun-82	Sep-82	Dec-82	Mar-83	Jun-83	Sep-83	Dec-83	Mar-84	Jun-84	Sep-84	Dec-84	Mar-85	total
CIGNA CORPORATION	1673908	482308	0	0	0	0	0	0	0	0	0	0	0
PRUDENTIAL INS CO/AMER	1440400	1257100	1234100	527500	0	0	0	0	0	10400	0	0	0
DONALDSON LUFKIN	658896	209646	25200	25200	0	25200	0	12300	0	0	0	0	21377
CHASE MANHATTAN CORP	395473	161073	52773	50873	48673	13073	12273	19973	0	0	0	0	0
INVESTORS RESEARCH CORP	0	0	0	0	0	0	0	0	0	0	0	0	0
HARRIS TRUST & SVGS BANK	123000	112000	54000	32000	20000	20000	18000	18000	15000	16000	0	0	0
SEARS INVESTMENT MGMT	532700	532700	0	0	0	0	0	0	0	0	0	0	150000
AXE E W & CO INC	386500	50000	0	0	0	0	0	0	0	0	0	0	11000
MACKAY SHIELDS FINANCIAL	0	0	0	0	0	0	0	0	0	0	0	0	0
GENERAL ELEC PENSION TR	300000	300000	299800	200000	200000	0	0	0	0	0	0	0	0
WARBURG PINCUS COUNSELLR	293000	282400	0	0	0	0	0	0	0	0	0	0	0
WALL PATTERSON HAMILTON	97381	10300	0	0	0	0	0	0	0	0	0	0	0
EAGLE MGMT & TRUST CO	275900	102900	10000	0	0	0	0	0	0	0	0	0	0
FIRST INTERSTATE/DENVER	262916	109696	115246	362916	388616	388416	487109	487109	478209	485109	1239	1239	224193
SCUDDER STEVENS & CLARK	170988	206558	150026	78961	108913	68813	54536	47595	43861	0	0	0	0
WELLINGTON MANAGEMENT	351950	360175	31900	0	0	0	0	0	0	0	0	0	142875
STATE FARM MUT AUTO INS	215000	215000	215000	215000	215000	0	0	0	0	0	0	0	0
SMITH BARNEY INC	173648	175748	181850	227050	204000	51100	16300	13700	8500	10200	3900	1200	12200
LOOMIS SAYLES	158856	332860	36600	0	0	0	0	0	0	0	0	0	121476
EXXON CORP	202100	220100	175100	160000	119400	19400	19400	19400	18200	18200	18200	12000	18000
FOUNDERS ASSET MGMT INC	30000	0	0	0	0	0	0	0	0	0	0	0	0
ROTHSCHILD L F ASSET MGT	102000	112000	214000	0	0	0	0	0	0	0	0	0	37000
HERITAGE WISCONISN CORP	175725	0	0	0	0	0	0	0	0	0	0	0	0
PACIFIC MUT LF INS CO	185100	10700	0	0	0	0	0	0	0	0	0	0	10000
USAA INV MGMT CO	165000	165000	35000	0	0	0	0	0	0	0	0	0	0
MANUFACTURERS LF INS CO	0	0	0	0	0	0	0	0	0	0	0	0	0
MARYLAND STATE RETIRMENT	159300	42900	42900	42900	0	0	42900	42900	208300	208300	0	0	49000

Institution	Jun-82	Sep-82	Dec-82	Mar-83	Jun-83	Sep-83	Dec-83	Mar-84	Jun-84	Sep-84	Dec-84	Mar-85	total
WELLS FARGO & COMPANY	161700	166100	173000	0	0	0	194500	204299	190951	202751	0	0	44999
MUTUAL OF AMERICA LIFE	140764	35764	0	0	0	0	0	0	0	0	0	0	0
OPPENHEIMER & CO	0	202418	665500	253200	1200	0	0	0	0	0	0	0	512282
KINGSLEY JENNISON MCNLTY	0	0	0	0	0	0	0	0	0	0	0	0	0
COLLEGE RETIRE EQUITIES	294300	624300	824300	524300	524300	524300	274300	274300	274300	274300	0	0	674300
DEAN WITTER REY INTERCAP	151250	185800	209650	225550	263650	204100	143300	94700	10700	10700	0	0	119700
SCHRODER CAPITAL MGMT	26500	17400	0	0	0	0	0	0	0	0	0	0	0
UNION CARBIDE CORP	0	0	0	0	0	0	0	0	0	0	0	0	0
FIRST INTERSTATE BANCORP	59158	19168	92242	84210	47510	47510	12612	23790	23990	34490	16790	17590	0
PROVIDENT INV COUNSEL	15940	0	10000	0	0	0	0	0	0	0	0	0	0
BANKERS TR N Y CORP	148400	136000	174900	174600	0	0	127800	413400	400500	354600	0	0	282700
GLICKENHAUS	186700	108600	0	0	0	0	0	0	0	0	0	0	60200
CITICORP	53564	21467	9960	0	0	0	0	0	0	0	0	0	0
BANKAMERICA CORP	74500	244500	190200	0	0	0	0	0	0	0	0	0	123230
CRITERION GROUP INC	0	0	0	0	0	0	0	0	0	0	0	0	0
TRAVELERS CORP	104000	102400	85800	85800	67800	77800	82800	8880	8880	8880	0	0	0
CAMPBELL ADVISORS INC	99000	44300	0	0	0	0	0	0	0	0	0	0	0
VALUE LINE INC	50000	0	0	0	0	0	0	32600	32600	32600	32600	32600	0
STATE UNIV RET SYS/ILL	100000	150000	0	0	0	0	0	0	0	0	0	0	50000
GTE INVESTMENT MGMT CORP	0	0	0	0	0	0	0	0	0	0	0	0	0
SEATTLE FIRST NATL BANK	80350	131350	21090	14590	0	0	0	0	0	0	0	0	44700
STEIN ROE & FARNHAM	77900	116240	103440	79684	26300	70300	166100	19100	32000	14400	0	34500	82900
FIRST NATL BK/CINCINNATI	78880	74980	68180	60880	32080	0	0	0	0	0	0	0	700
CENTRAL TRUST CO NA	55150	48675	27850	26700	37850	25150	17350	0	0	0	0	0	0
NORTHWESTERN MUT LF INS	0	0	0	750000	1000000	1100000	750000	650000	650000	650000	155200	100000	1024000
PUTNAM COMPANIES	0	0	0	0	0	0	0	0	0	0	0	0	0
SENTRY INV MGMT INC	92500	92500	92500	15000	0	0	0	0	0	0	0	0	20000
CIGNA INVESTMENT ADVISOR	0	0	0	0	0	0	0	0	0	0	0	0	0
AMERICAN NAT B+T/CHICAGO	83500	85000	84600	119400	119400	119500	125900	129100	107100	107500	115340	97140	59400
ST PAUL COMPANIES INC	0	0	0	0	0	0	0	0	0	0	0	0	0
BRUNDAGE STORY & ROSE	81670	99570	117690	169590	194840	221750	208450	299204	329904	339954	299204	259004	280984
FIRST CHICAGO CORP	198292	274392	0	0	0	0	0	0	0	0	0	0	215800
INA CAPITAL MGMT CORP	59400	20900	0	0	0	0	0	0	0	0	0	0	1600
PITTSBURGH NAT B/T DEPT	42500	34000	30000	30601	0	0	0	0	0	0	0	0	0

Institution	Jun-82	Sep-82	Dec-82	Mar-83	Jun-83	Sep-83	Dec-83	Mar-84	Jun-84	Sep-84	Dec-84	Mar-85	total
COMBINED INS / AMERICA	40000	40000	0	0	0	0	0	0	0	0	0	0	0
FIRST CITY BANCORP TEXAS	62850	66000	43500	0	0	21700	16700	0	0	0	0	0	11000
FIRST KENTUCKY NATIONAL	0	0	0	0	0	0	0	0	0	0	0	0	0
HUNTINGTON BANCS INC	50500	66600	15900	11100	0	0	0	0	0	0	0	0	12800
BJURMAN GEORGE D & ASSOC	51000	13000	0	0	0	0	0	0	0	0	0	0	0
IDAHO FIRST NATIONAL BK	51600	25900	24300	24300	23900	23900	23900	23900	23550	20850	0	0	2700
BANK OF OKALHOMA	0	0	0	0	0	0	0	0	0	0	0	0	0
ELFUN TRUSTS	40000	40000	0	0	0	0	0	0	0	0	0	0	0
FIRST PENNSYLVANIA CORP	11060	117600	215000	69772	18900	50600	46300	131200	27200	26800	0	0	176940
CROCKER NATIONAL	0	30200	33400	17700	17700	15500	0	0	0	0	0	0	0
WITTER WILLIAM D INC	32900	0	0	0	0	0	0	0	0	0	0	0	0
MANUFACTURERS NATIONAL	32860	33060	33760	33760	33560	33560	33560	33560	33560	33660	33560	34060	900
BOSTON COMPANY INC	29450	22850	37950	37350	34300	34300	19300	19300	19300	19300	0	0	5100
WERTHEIM & CO	38274	29724	45224	48424	20524	25924	17524	17300	13000	13000	12500	12500	16450
AMERICAN TEL & TEL INDEX	31200	31200	32100	32100	32100	32100	32100	32100	32100	32100	32100	32100	900
LINCOLN NATIONAL CORP	26500	26500	49000	21000	0	0	0	0	0	0	0	0	18800
MARSHALL & ILSLEY CORP	0	0	0	0	0	0	0	0	0	0	0	0	0
CONTINENTAL INV ADVISORS	40000	40000	40000	40000	0	0	0	0	0	0	0	0	10000
MASSACHUSETTS FINL SVCS	0	0	0	0	0	0	0	0	0	0	0	0	0
LEHMAN BROTHRS KUHN LOEB	0	2990	3900	0	0	0	0	2300	0	0	0	0	0
BARCLAYS PLC	32000	22000	0	0	0	25200	0	0	0	0	0	0	5000
COMERICA INC	34600	37850	32700	21417	11950	0	0	0	0	0	0	0	11250
FIRST NATL BK&TR/LINCOLN	25996	12996	0	5000	0	0	0	0	0	0	0	0	0
BULLOCK CALVIN	40000	44200	28200	26900	0	0	0	0	0	0	0	0	19200
HONGKONG & SHANGHAI BANK	33500	64500	39500	70000	100000	100000	100000	100000	0	0	0	0	75500
GIRARD BANK	16100	16100	0	9504	0	0	0	0	0	0	0	0	0
CIC ASSET MANAGEMENT	23762	23762	23762	23762	23762	23762	23762	23762	23762	23762	0	0	0
BANK OF CALIFORNIA	28660	33320	0	19859	30719	34720	57420	0	0	51460	38560	34910	34360
NATIONAL INVT SVC/AMER	0	0	0	0	0	0	0	0	0	0	0	0	0
ESSEX INV MGMT CO INC	0	0	0	0	0	0	0	0	0	0	0	0	0
NEVILLE - RODIE & SHAW	71500	53500	58500	5300	0	0	0	0	0	0	0	0	51500
WELCH & FORBES INC	17648	10488	0	0	0	0	0	0	0	0	0	0	0
BANK OF NEW JERSEY	18000	18000	18000	18000	18000	0	0	0	0	0	0	0	0
RUSSELL FRANK CO INC	30800	13800	0	0	50000	59000	59000	54400	54400	54400	0	0	41500

Institution	Jun-82	Sep-82	Dec-82	Mar-83	Jun-83	Sep-83	Dec-83	Mar-84	Jun-84	Sep-84	Dec-84	Mar-85	total
FORT HILL INVESTORS MGMT	0	0	0	0	0	0	0	0	0	0	0	0	0
NORTHERN TRUST CORP	16480	21208	13208	13208	0	0	0	13200	36000	36000	0	0	19520
BANK OF TOKYO LTD	0	0	0	0	0	0	0	0	0	0	0	0	0
EQUITABLE BANCORP	14700	0	0	0	0	0	0	0	0	0	0	0	0
CHEMICAL BANKING CORP.	14402	0	0	619054	705154	857744	730194	656094	647334	629134	0	0	843490
AMERITRUST CO	16096	12596	0	19696	22696	35596	52796	15400	0	0	0	0	38600
PROVIDENT NATIONAL	14600	11700	14400	0	0	0	0	0	0	0	0	0	700
PHILADELPHIA NATIONAL BK	13700	0	0	0	0	0	0	0	0	0	0	0	0
STATE STREET BOSTON CORP	0	13300	13300	0	0	16400	0	0	22700	18700	18700	0	9700
VALLEY NATIONAL BK/ARIZ	10400	10600	11100	11100	15100	20000	14700	14700	0	0	0	0	7800
COLUMBIA MANAGEMENT	0	0	0	0	0	0	0	0	0	0	0	0	0
CHASE LINCOLN FIRST BANK	9658	0	0	0	0	0	0	0	0	0	0	0	0
COOLIDGE LAWRENCE	11715	11715	11715	11715	11715	11715	13192	13192	13192	13192	13192	13192	1477
MANUFACTURERS HANOVER TR	104200	0	127950	29400	8600	8600	7200	6700	0	0	0	0	116350
DOMINION TRUST COMPANY	0	0	0	1000	0	0	0	0	0	0	0	0	0
METROPOLITAN LIFE INSUR	18300	23300	101600	140600	139100	141100	103100	46300	2800	2800	0	0	130300
TRAINER WORTHAM & CO	10400	1800	1800	1800	2400	1000	1000	1000	600	0	0	0	0
KEMPER FINANCIAL SERVICE	0	0	0	0	0	0	0	0	0	0	0	0	0
UNIVERSITY OF TEXAS SYS	10000	10000	0	0	0	0	0	0	0	0	0	0	0
HUNTINGTON BK/N.E. OHIO	11044	20150	0	0	0	0	0	0	0	0	0	0	10600
FIRST NATL BK/MINNEAPLIS	16700	18000	18400	18000	0	0	0	0	0	0	0	0	8900
NATIONAL CITY BANK	9665	12731	9799	0	0	0	0	0	12000	0	0	0	3424
BANC OHIO NATL BK	37761	34627	34282	0	0	0	0	0	0	0	0	0	28954
TCW ASSET MANAGEMENT	0	0	0	0	0	0	0	0	0	0	0	0	0
INTERFIRST CORPORATION	0	0	0	0	12100	121600	0	0	0	0	0	0	113600
ROCKEFELLER & CO	0	0	0	0	0	0	0	0	0	0	0	0	0
HARVARD COLLEGE	7000	0	0	0	0	1400	0	0	0	162100	20000	20000	155045
MORGAN STANLEY GROUP INC	10200	16600	429300	0	0	0	0	0	0	0	0	0	422600
FIDUCIARY TR CO/NEW YORK	4891	1191	0	0	0	0	0	0	0	0	0	0	0
NEUBERGER & BERMAN	3196	0	30000	0	0	0	0	0	0	0	0	0	24310
SCHRODER J HENRY BK&TR	396	0	1000	0	0	0	0	0	0	0	0	0	0
COLONIAL BANK	0	0	0	0	0	0	0	0	0	0	0	0	0
BANK OF DELAWARE	3700	0	0	0	0	0	0	0	0	0	0	0	0
MICHIGAN NATL BK/DETROIT	2900	1100	1100	700	0	1100	1100	1100	1100	1500	1100	1100	0

Institution	Jun-82	Sep-82	Dec-82	Mar-83	Jun-83	Sep-83	Dec-83	Mar-84	Jun-84	Sep-84	Dec-84	Mar-85	total
AETNA LIFE & CASUALTY CO	96400	14900	2400	2400	2400	1800	1600	1700	1700	1700	0	0	93900
IRVING TRUST CO	594	0	0	0	0	0	0	0	0	0	0	0	0
BATTERYMARCH FINL MGMT	51000	69300	70600	70600	70700	70900	71300	72500	74700	76200	0	0	73800
EATON VANCE MANAGEMENT	2000	1000	0	0	0	0	1514500	1643200	1807400	1798500	3100	2500	1805800
CITYTRUST	0	1560	1160	0	0	0	0	0	0	0	0	0	0
SHIELDS ASSET MGMT INC	1000	0	0	0	0	0	0	0	0	0	0	0	0
Total Institutions	12,479,517	9,730,506	7,522,207	6,011,026	5,024,912	4,745,633	5,693,878	5,733,258	5,679,393	5,793,542	815,285		8,797,386

Source: Thomson Financial Securities Data

TABLE D

RATIO OF RETAINED SHARES FROM CLAIMS SUBMISSIONS TO THE RETAINED SHARES FROM THE GTM (1X) FOR MIDWESTERN

Retained Shares Estimated from GTM (1x) Corrected for Proper Adjustment of 60% of Reported Volume	1,880,000
Retained Shares resulting from Claims Submissions (source: Cone and Laurence)	1,550,000
Ratio of Retained Shares from Claims Submission to Retained Shares from GTM (1x)	82.4%

DATA FOR B AND C

Total Float	10,000,000
Daily Volume	100,000
Days in Class period	25

One Trader	**Total**	**1**
Acceleration Factor	1	99.00%
		1.010%
Damaged Shares	2,221,786	2,221,786

Two Trader	**Total**	**1**	**2**
Fraction of Float	100%	80%	20%
Propensity to Trade		1	2
Daily Volume		66,667	33,333
		0.84%	1.69%
Damaged Shares	2,196,317	1,510,176.73	686,140.19

Two Trader	**Total**	**1**	**2**
Fraction of Float	100%	80%	20%
Propensity to Trade		1	3
Daily Volume		57,143	42,857
		0.72%	2.19%
Damaged Shares	2,148,866	1,312,572.27	836,293.98

Two Trader	**Total**	**1**	**2**
Fraction of Float	2882312670%	80%	20%
Propensity to Trade		1	4
Daily Volume		50,000	50,000
		0.63%	2.56%
Damaged Shares	2,098,541	1,160,591.74	937,948.96

Two Trader	**Total**	**1**	**2**
Fraction of Float	765%	80%	20%
Propensity to Trade		1	5
Daily Volume		44,444	55,556
		0.56%	2.86%
Damaged Shares	2,051,161	1,040,097.85	1,011,063.09

Two Trader	**Total**	**1**	**2**
Fraction of Float	1000%	80%	20%
Propensity to Trade		1	10
Daily Volume		28,571	71,429
		0.36%	3.70%
Damaged Shares	1,878,796	684,495.44	1,194,300.09

Two Trader	**Total**	**1**	**2**
Fraction of Float	15741%	80%	20%
Propensity to Trade		1	15
Daily Volume		21,053	78,947
		0.26%	4.11%
Damaged Shares	1,779,288	510,025.82	1,269,262.00

Two Trader	**Total**	**1**	**2**
Fraction of Float	55839%	80%	20%
Propensity to Trade		1	20
Daily Volume		16,667	83,333
		0.21%	4.35%
Damaged Shares	1,716,262	406,414.49	1,309,847.84